

* NOTICES *

JPO and INPIT are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.**** shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]

This invention relates especially to an organic electroluminescence (EL) element about a carbazole derivative, its polymer, and the light emitting device containing it.

[0002]

[Description of the Prior Art]

The ideal low molecule host material which has high T_1 as a host material for organic electroluminescence devices recognizes various existence. When using these for manufacture of a light emitting device, there is the necessity for vacuum deposition. Therefore, the host material of the polymer type which can be applied from viewpoints of simplification of a manufacturing process, processability, large-area-izing, etc. is desirable.

[0003]

If the host polymer known now is applied in the shape of a film, T_1 will fall substantially and luminous efficiency will also fall. The bis(diarylamine)carbazole derivative which has diarylamine in the carbazole group in a carbazole system polymer is indicated by JP,2002-47271,A and JP,2002-124389,A. Host polymer in which short wave luminescence that it can apply and efficient is possible was not found out, but development was desired.

[0004]

[Problem(s) to be Solved by the Invention]

The first purpose of this invention is in offer of the guest material in the luminous layer which gives the blue of an organic EL device in which triplet emission is possible - blue-green phosphorescence. the second purpose of this invention has the minimum excitation triplet energy -- and spreading -- it is in offer about an usable polymer system host material.

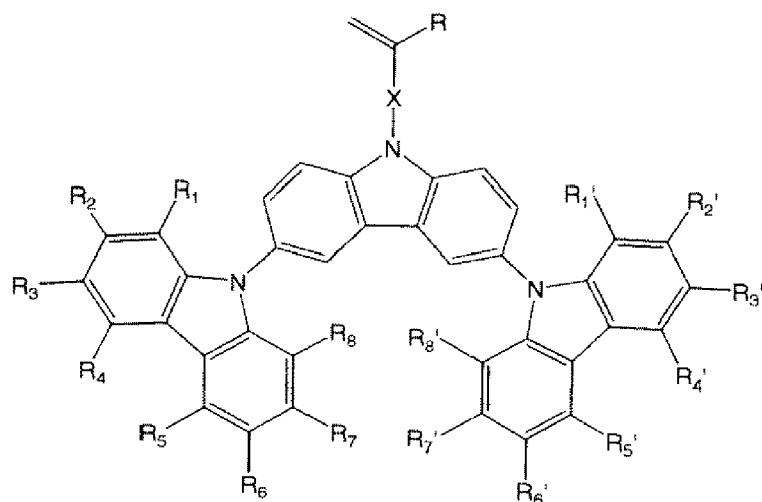
[0005]

The above-mentioned technical problem is attained by the following means.

General formula (I)

[0006]

[Formula 6]



[0007]

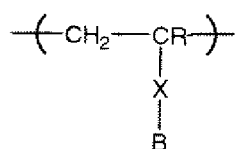
(In general formula (I)) $R - R_1 - R_2 - R_3 - R_4 - R_5 - R_6 - R_7 - R_8 - R_1 - R_2 - R_3 - R_4 - R_5 - R_6 - R_7$. And R_8 may be the same, or may differ and expresses a hydrogen atom or a substituent. X expresses the organic group of a single bond or bivalence.

(2) Polymer which has a repeating unit expressed with general formula (II).

General formula (II)

[0008]

[Formula 7]

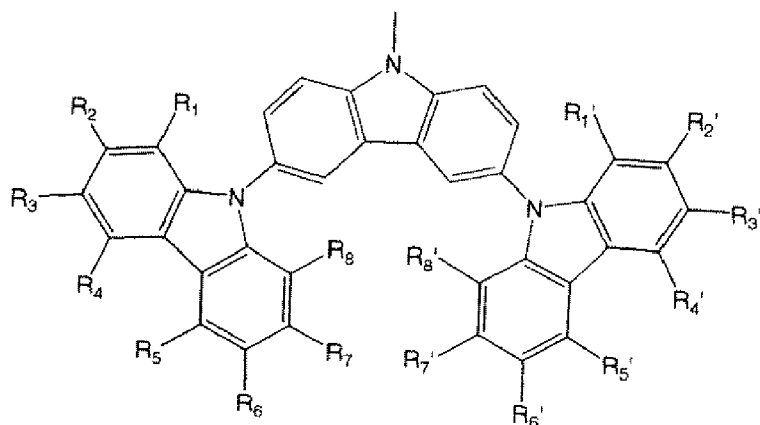


[0009]

(In general formula (II), R expresses a hydrogen atom or a substituent.) X expresses the organic group of a single bond or bivalence. B,

[0010]

[Formula 8]



[0011]

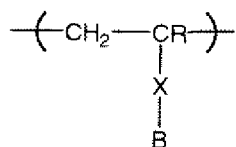
It comes out. here -- R -- ₁ -- R -- ₂ -- R -- ₃ -- R -- ₄ -- R -- ₅ -- R -- ₆ -- R -- ₇ -- R -- ₈ -- R -- ₁ -- ' -- R -- ₂ -- ' -- R -- ₃ -- ' -- R -- ₄ -- ' -- R -- ₅ -- ' -- R -- ₆ -- ' -- R -- ₇ -- '. and R₈' may be the same, or may differ and expresses a hydrogen atom or a substituent.

(3) The light emitting device which is a light emitting device which has two or more organic layers which contain a luminous layer or a luminous layer in inter-electrode [of a couple], and contains the polymer which has a repeating unit to which at least one layer is expressed with following general formula (II).

General formula (II)

[0012]

[Formula 9]

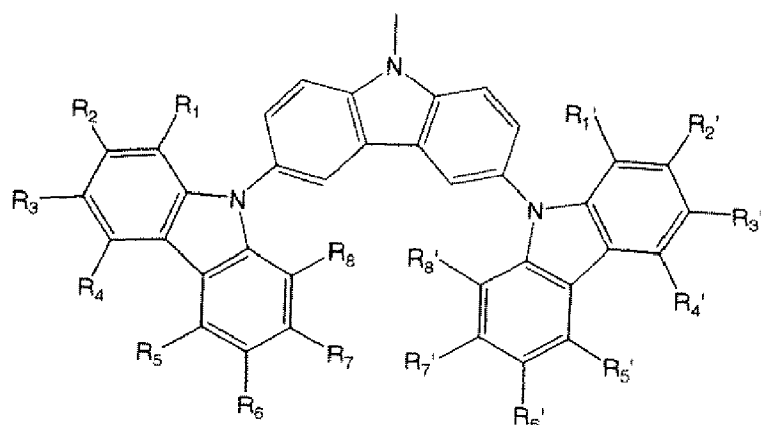


[0013]

(In general formula (II), R expresses a hydrogen atom or a substituent.) X expresses the organic group of a single bond or bivalence. B,

[0014]

[Formula 10]



[0015]

It comes out. here -- R -- ₁ -- R -- ₂ -- R -- ₃ -- R -- ₄ -- R -- ₅ -- R -- ₆ -- R -- ₇ -- R -- ₈ -- R -- ₁ -- ' -- R -- ₂ -- ' -- R -- ₃ -- ' -- R -- ₄ -- ' -- R -- ₅ -- ' -- R -- ₆ -- ' -- R -- ₇ -- '. and R₈' may be the same, or may differ and expresses a hydrogen atom or a substituent.

[0016]

[Embodiment of the Invention]

Hereafter, this invention is explained in detail.

(Carbazole derivative)

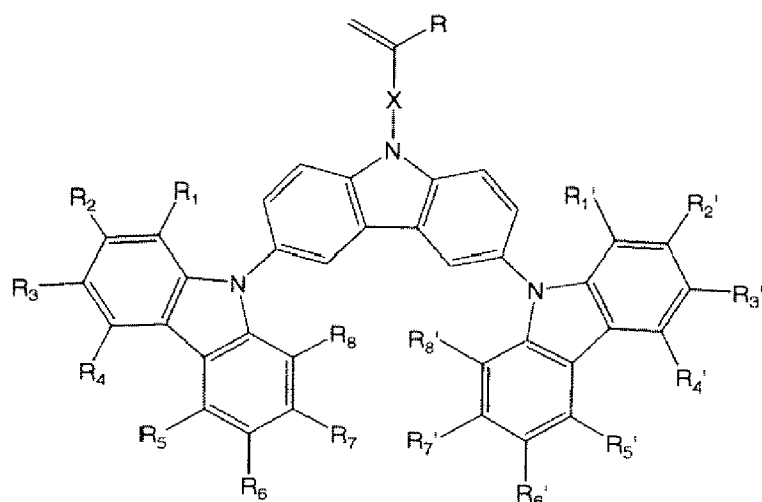
This invention is a compound expressed with following general formula (I) in the first place.

This compound is a monomer used for composition of the polymer which has a repeating unit expressed with above general formula (II).

General formula (I)

[0017]

[Formula 11]



In general formula (I), R -- R --₁--R --₂--R --₃--R --₄--R --₅--R --₆--R --₇--R --₈--R --₁--'--R --₂--'--R --₃--'--R --₄--'--R --₅--'--R --₆--'--R --₇--'. And R₈' may be the same, or it may differ, a hydrogen atom or a substituent is expressed, and X expresses the organic group of a single bond or bivalence.

R -- R --₁ -- R --₂ -- R --₃ -- R --₄ -- R --₅ -- R --₆ -- R --₇ -- R --₈ -- R --₁ -- ' -- R --₂ -- ' -- R --₃ -- ' -- R --₄ -- ' -- R --₅ -- ' -- R --₆ -- ' -- R --₇ -- '. And the substituent of the following monovalence is mentioned as a substituent expressed with R₈'.

[0019]

(Substituent of monovalence)

an alkyl group (desirable -- the carbon numbers 1-20 -- more -- desirable -- the carbon numbers 1-12 -- it being the carbon numbers 1-8 preferably, and especially) For example, methyl, ethyl, iso-propyl, tert-butyl, n-octyl, n-decyl, n-hexadecyl, cyclopropyl, cyclopentyl, cyclohexyl etc. are mentioned -- an alkenyl group (desirable -- the carbon numbers 2-20 -- more -- desirable -- the carbon numbers 2-12 -- it being the carbon numbers 2-8 preferably, and especially) for example, vinyl, allyl, 2-butenyl, 3-pentenyl, etc. are mentioned. an alkynyl group (desirable -- the carbon numbers 2-20 -- more -- desirable -- the carbon numbers 2-12 -- it being the carbon numbers 2-8 preferably, and especially) for example, propargyl, 3-pentynyl, etc. are mentioned -- an aryl group (desirable -- the carbon numbers 6-30 -- more -- desirable -- the carbon numbers 6-20 -- it being the carbon numbers 6-12 preferably, and especially) For example, phenyl, p-methylphenyl, naphthyl, anthryl, phenanthryl, pyrenyl etc. are mentioned -- an amino group (desirable -- the carbon numbers 0-20 -- more -- desirable -- the carbon numbers 0-10 -- they are the carbon numbers 0-6 especially preferably -- for example, amino

** methylamino, dimethylamino, and diethylamino.) dibenzylamino etc. are mentioned. **

[0020]

an alkoxy group (desirable -- the carbon numbers 1-20 -- more -- desirable -- the carbon numbers 1-12 -- it being the carbon numbers 1-8 preferably, and especially) for example, methoxy, ethoxy ** butoxy, etc. are mentioned -- an aryloxy group (desirable -- the carbon numbers 6-20 -- more -- desirable -- the carbon numbers 6-16 -- it being the carbon numbers 6-12 preferably, and especially) for example, phenyloxy, 2-naphthyloxy, etc. are mentioned. a heterocycle oxy group (desirable -- the carbon numbers 2-20 -- more -- desirable -- the carbon numbers 3-16 -- it being the carbon numbers 4-12 preferably, and especially) for example, pyridinooxy, pilus MIJINO oxy, pyridazino oxy, benzimidazolyl oxy, etc. are mentioned. a silyloxy group (desirable -- the carbon numbers 3-40 -- more -- desirable -- the carbon numbers 3-30 -- it being the carbon numbers 3-20 preferably, and especially) for example, trimethylsilyloxy, t-butyldimethylsilyloxy, etc. are mentioned. an acyl group (desirable -- the carbon numbers 1-20 -- more -- desirable -- the carbon numbers 1-16 -- especially, it is the carbon numbers 1-12 preferably, for example, acetyl, benzoyl, formyl, pivaloyl, etc. are mentioned.),

[0021]

an alkoxycarbonyl group (desirable -- the carbon numbers 2-20 -- more -- desirable -- the carbon numbers 2-16 -- it being the carbon numbers 2-12 preferably, and especially) for example, carbomethoxy, ethoxycarbonyl, etc. are mentioned. an aryloxy carbonyl group (desirable -- the carbon numbers 7-20 -- more -- desirable -- the carbon numbers 7-16 -- it being the carbon numbers 7-10 preferably, and especially) for example, phenyloxy carbonyl etc. are mentioned -- an acyloxy group (desirable -- the carbon numbers 2-20 -- more -- desirable -- the carbon numbers 2-16 -- it being the carbon numbers 2-10 preferably, and especially) for example, acetoxyl, benzoyloxy one, etc. are mentioned -- the acylamino group (desirable -- the carbon numbers 2-20 -- more -- desirable -- the carbon numbers 2-16 -- it being the carbon numbers 2-10 preferably, and especially) for example, acetylamino, benzoylamino, etc. are mentioned -- an alkoxycarbonylamino group (desirable -- the carbon numbers 2-20 -- more -- desirable -- the carbon numbers 2-16 -- it being the carbon numbers 2-12 preferably, and especially) for example, methoxycarbonylamino etc. are mentioned -- an aryloxycarbonylamine group (desirable -- the carbon numbers 7-20 -- more -- desirable -- the carbon numbers 7-16 -- it being the carbon numbers 7-12 preferably, and especially) for example, phenyloxy carbonylamino etc. are mentioned. **

[0022]

a sulfonylamino group (desirable -- the carbon numbers 1-20 -- more -- desirable -- the carbon numbers 1-16 -- it being the carbon numbers 1-12 preferably, and especially) for example, methanesulfonylamino, benzenesulphonyl amino, etc. are mentioned. a sulfamoyl group

(desirable -- the carbon numbers 0-20 -- more -- desirable -- the carbon numbers 0-16 -- it being the carbon numbers 0-12 preferably, and especially) For example, sulfamoyl, methyl sulfamoyl, dimethyl sulfamoyl, phenyl sulfamoyl etc. are mentioned -- a carbamoyl group (desirable -- the carbon numbers 1-20 -- more -- desirable -- the carbon 1-16 -- it being the carbon numbers 1-12 preferably, and especially) For example, carbamoyl, methylcarbamoyl, diethylcarbamoyl, phenylcarbamoyl etc. are mentioned -- an alkylthio group (desirable -- the carbon numbers 1-20 -- more -- desirable -- the carbon numbers 1-16 -- it being the carbon numbers 1-12 preferably, and especially) for example, a methylthio, ethylthio, etc. are mentioned -- an arylthio group (desirable -- the carbon numbers 6-20 -- more -- desirable -- the carbon numbers 6-16 -- it being the carbon numbers 6-12 preferably, and especially) for example, phenylthio etc. are mentioned -- a heterocycle thio group (desirable -- the carbon numbers 1-20 -- more -- desirable -- the carbon numbers 2-16.) especially, it is the carbon numbers 4-12 preferably, for example, pyridinothio, pilus midge OCHIO, pyridazino thio, benzimidazolyl thio, thiadiazolyl thio, etc. are mentioned. **

[0023]

a sulfonyl group (desirable -- the carbon numbers 1-20 -- more -- desirable -- the carbon numbers 1-16 -- it being the carbon numbers 1-12 preferably, and especially) for example, mesyl, tosyl, etc. are mentioned -- a sulfinyl group (desirable -- the carbon numbers 1-20 -- more -- desirable -- the carbon numbers 1-16 -- it being the carbon numbers 1-12 preferably, and especially) for example, methanesulfinyl, benzenesulfinyl, etc. are mentioned. an ureido group (desirable -- the carbon numbers 1-20 -- more -- desirable -- the carbon numbers 1-16 -- it being the carbon numbers 1-12 preferably, and especially) for example, ureido, methyl ureido, phenyl ureido, etc. are mentioned. an amide phosphate group (desirable -- the carbon numbers 1-20 -- more -- desirable -- the carbon numbers 1-16 -- it being the carbon numbers 1-12 preferably, and especially) for example, diethyl amide phosphate, phenyl amide phosphate, etc. are mentioned. a hydroxy group, a sulfhydryl group, and a halogen atom (for example, a fluorine atom and a chlorine atom.) a bromine atom, iodine atoms, a cyano group, a sulfonic group, a carboxyl group, a nitro group, a hydroxamic acid group, a sulfino group, a hydrazino group, an imino group, and a heterocycle group (desirable -- the carbon numbers 1-20 -- they are the carbon numbers 1-12 more preferably -- as a hetero atom -- a nitrogen atom and an oxygen atom.) On a sulfur atom and a concrete target, for example, imidazolyl, pyridyl, quinolyl, a furil, Thienyl, piperidyl, morpholino, benzoxazolyl, benzo imidazolyl, benzothiazolyl, carbazolyl, AZEPINIRU, etc. are mentioned. A silyl group (desirable -- the carbon numbers 3-40 -- more -- desirable -- 3-30 -- especially, it is 3-24 preferably, for example, trimethylsilyl, triphenylsilyl, etc. are mentioned.) etc. are mentioned. These substituents may be replaced further. when there are two or more substituents, it may be the same or may differ. When possible, it may connect mutually and a ring may be formed.

[0024]

It is a hydrogen atom or a methyl group preferably as R, and is a hydrogen atom especially preferably.

[0025]

R_1 , R_2 , R_4 , R_5 , R_7 , R_8 , R_1' , R_2' , R_4' , R_5' , R_7' and R_8' ***** -- desirable -- an alkyl group -- or -- a hydrogen atom -- it is.

It is a hydrogen atom especially preferably.

[0026]

It is a hydrogen atom, an alkyl group, an alkoxy group, an amino group, or a heterocycle group preferably as R_3 , R_6 , R_3' , and R_6' , is a hydrogen atom, an alkyl group, or a heterocycle group more preferably, and is a hydrogen atom especially preferably.

[0027]

as the organic group of expressing [with X] bivalence -- an alkylene group (desirable -- the carbon numbers 1-20 -- more -- desirable -- the carbon numbers 1-12 -- it being the carbon numbers 1-8 preferably, and especially) For example, a methylene group ($-\text{CH}_2-$), ethylene ($-\text{CH}_2\text{CH}_2-$), a trimethylene group ($-\text{CH}_2\text{CH}_2\text{CH}_2-$) etc. are mentioned. an allylene group (desirable -- the carbon numbers 6-30 -- more -- desirable -- the carbon numbers 6-20 -- it being the carbon numbers 6-12 preferably, and especially) for example, a phenylene group ($-\text{C}_6\text{H}_4-$), a naphthylene group ($-\text{C}_{10}\text{H}_6-$), etc. are mentioned. an oxyalkylene group (desirable -- the carbon numbers 1-20 -- more -- desirable -- the carbon numbers 1-12 -- it being the carbon numbers 1-8 preferably, and especially) For example, a oxymethylene group ($-\text{OCH}_2-$), an oxyethylene group ($-\text{OCH}_2\text{CH}_2-$), **** is mentioned -- a oxy allylene group (desirable -- the carbon numbers 6-20 -- more -- desirable -- the carbon numbers 6-16 -- it being the carbon numbers 6-12 preferably, and especially) for example, a oxyphenylene group ($-\text{OC}_6\text{H}_4-$), a oxy naphthylene group ($-\text{OC}_{10}\text{H}_6-$), etc. are mentioned. An oxycarbonyl group ($-\text{COO}-$), an imino carbonyl group ($-\text{CONH}-$), an ureylene group ($-\text{NHCONH}-$), etc. are mentioned. An organic group of such bivalence may be replaced by the further above-mentioned substituent.

[0028]

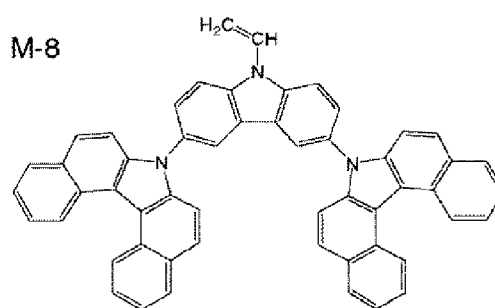
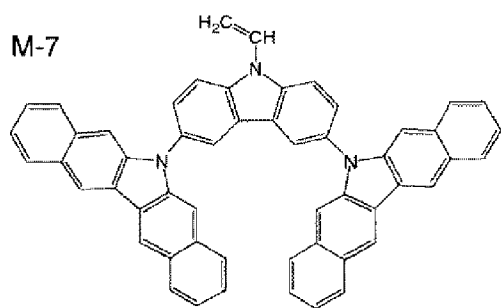
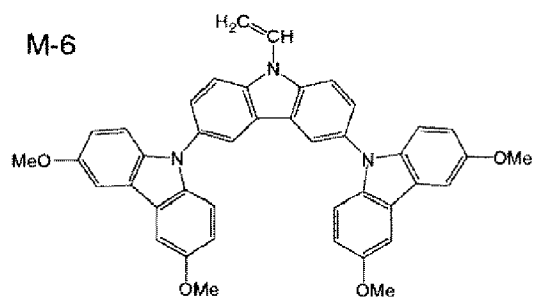
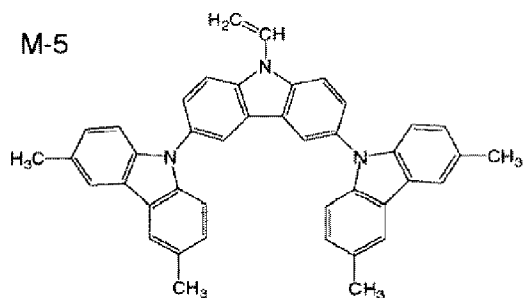
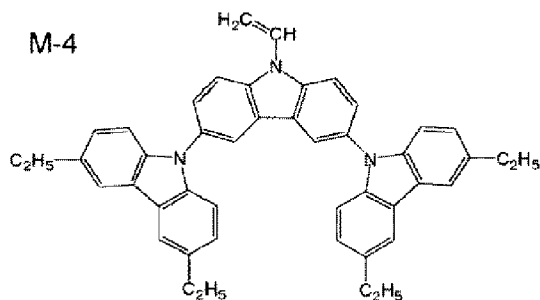
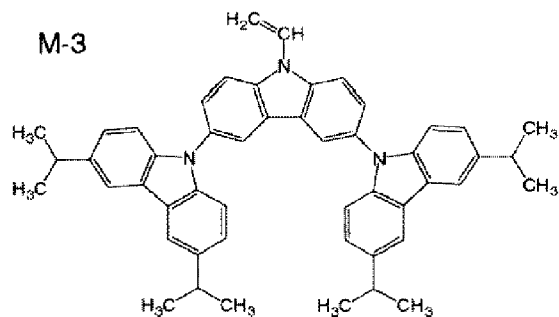
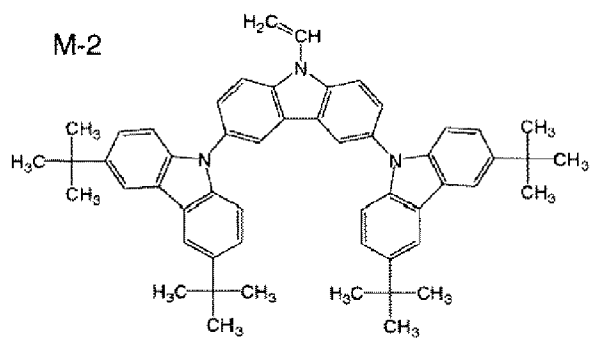
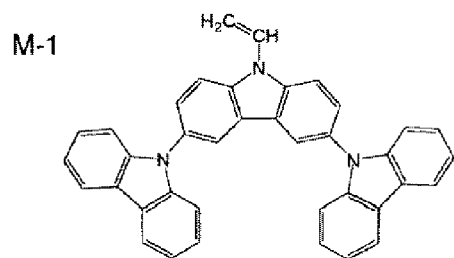
Preferably as X, it is a single bond, a methylene group, or a phenylene group, and is a single bond especially preferably.

[0029]

Although an example of a compound expressed with general formula (I) below is given, this invention is not limited to these.

[0030]

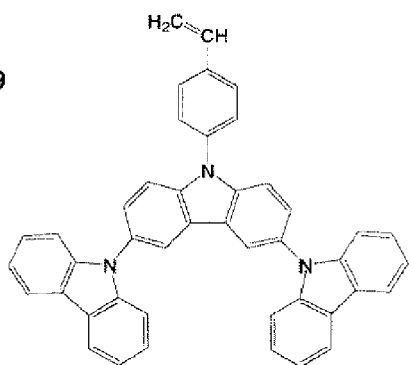
[Formula 12]



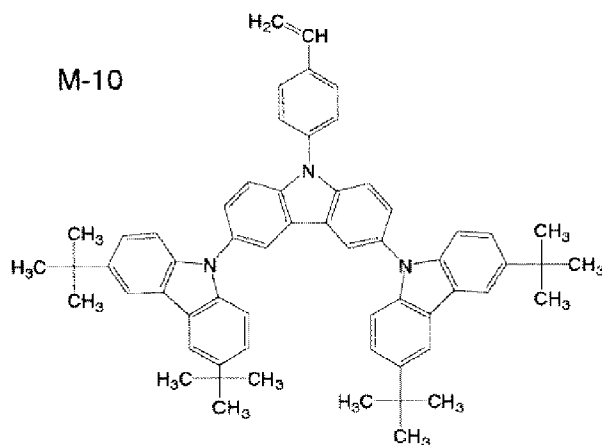
[0031]

[Formula 13]

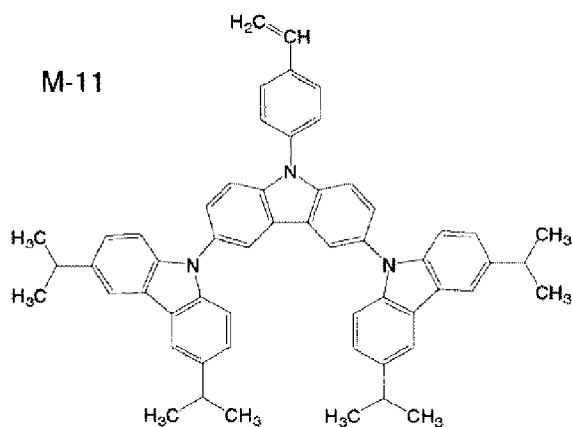
M-9



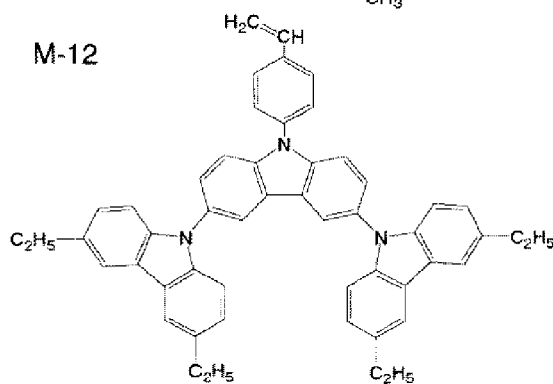
M-10



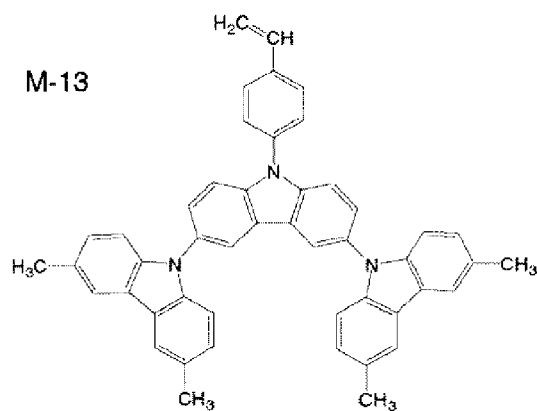
M-11



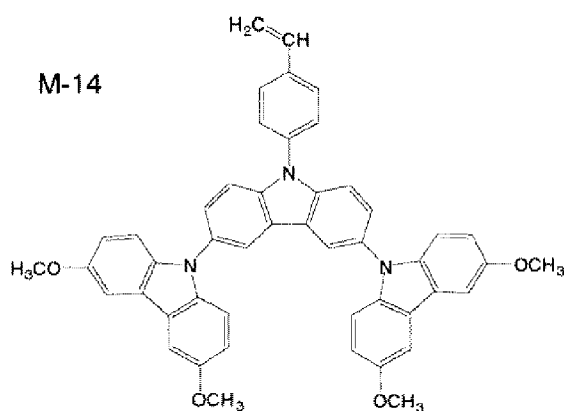
M-12



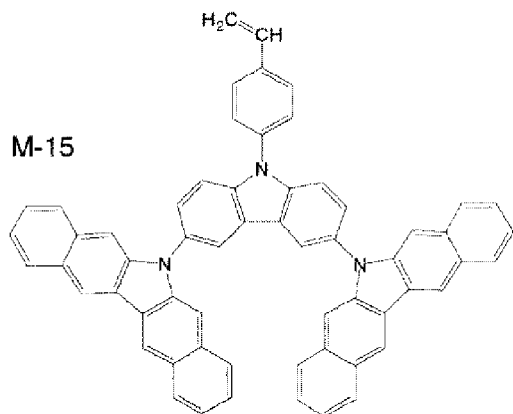
M-13



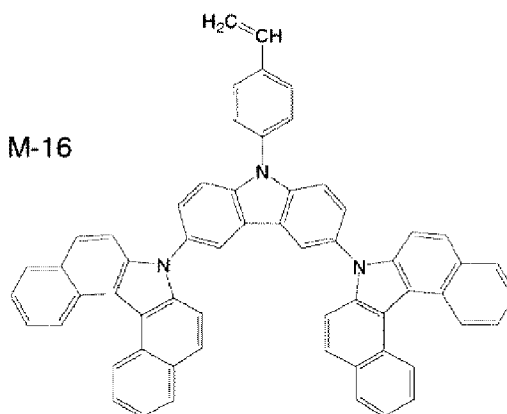
M-14



M-15



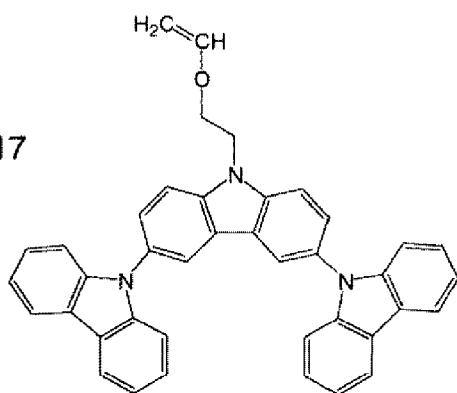
M-16



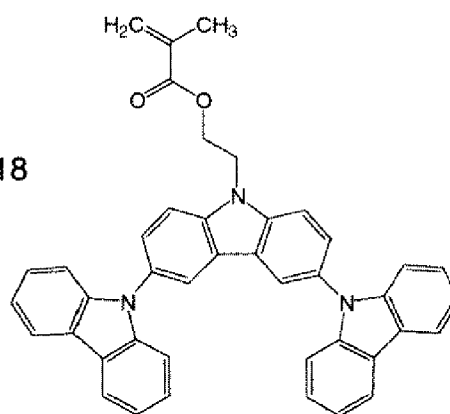
[0032]

[Formula 14]

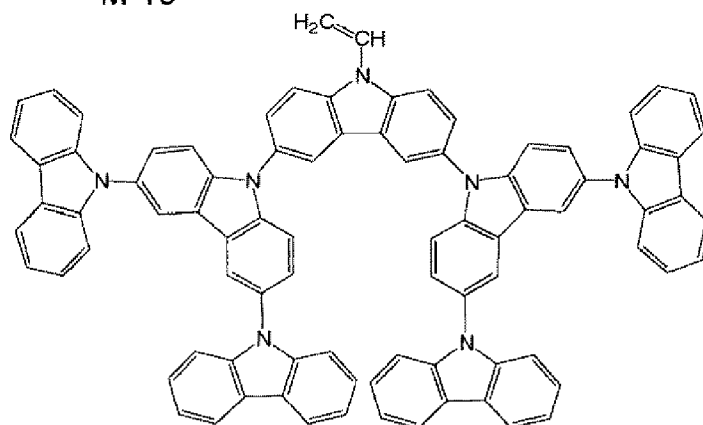
M-17



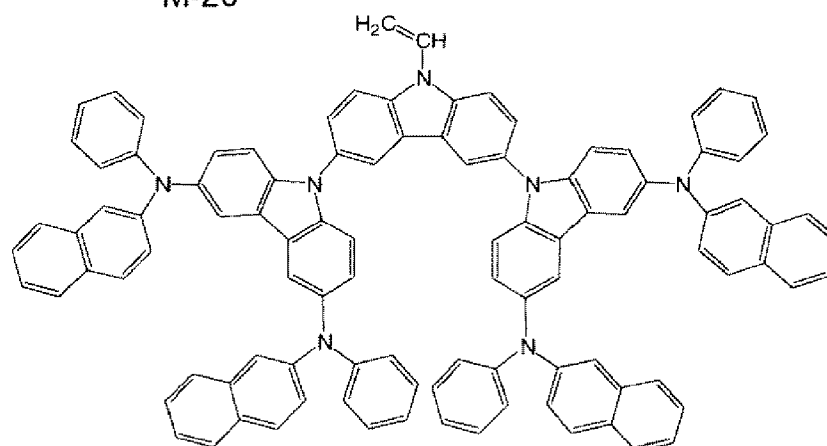
M-18



M-19



M-20



[0033]

Next, a part of synthetic example of a carbazole derivative expressed with general formula (I) in this invention is shown below. The 3,6-dibromocarbazole (made by Aldrich) and carbazole used as a raw material are [a commercial item] available, and it substitution carbazole, It is compoundable by substitution phenylhydrazine hydrochloride and substitution cyclohexanone ("precision organic synthesis" ***** p339-340, L.F.Tieze, Th.Eicher work, Koya, Ogasawara translation). Synthesis Communication 2000, 30, and 3341 are referred to, and N-vinylation can compound them.

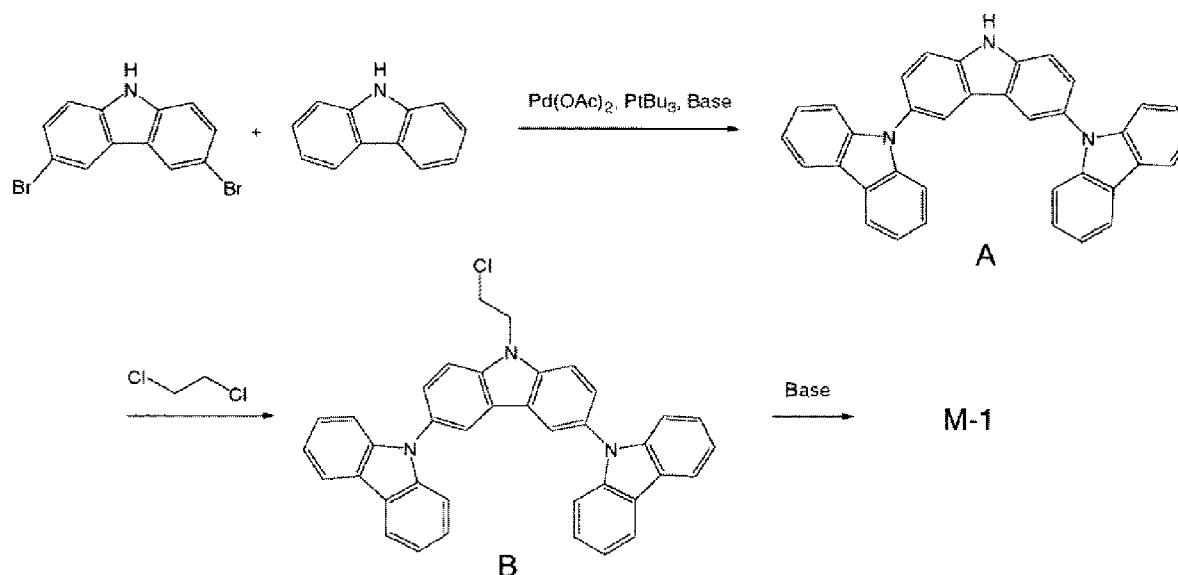
[0034]

The synthetic example 1

Composition of the illustration compound M-1

[0035]

[Formula 15]



[0036]

Composition of the intermediate A

In orthoxylene 100mL in the eggplant flask by which the nitrogen purge was carried out, 3, 35.0 g of 6 **JIBUROMO carbazole, 36.1 g of carbazole, 1.3 g of palladium acetate, tritertiary-butylphosphine 4.3mL, and 150.0 g of rubidium carbonate are taught, and it is made to react at 120 ** for 8 hours. 5.2g of white solids A are obtained by refining and recrystallizing output with column chromatography. 10% of yield.

Composition of the intermediate B

A4.8g compounded above is dissolved in 1,2-dichloroethane 28mL, the potassium hydrate 4.4g, the potassium carbonate 3.5g, and the tetrabutylammonium star's picture 0.3g are prepared, and it stirs at 60 to 70 ** for 6 hours. Suction filtration of the contents is carried out, methylene chloride 60mL and deionized water 5mL are added to a filtrate, and liquid separation extraction is carried out. Magnesium sulfate desiccation of the obtained organic layer is carried out, a solvent is evaporated, and vacuum concentration is carried out. This concentrate is given to column chromatography and the white solid B1.6g is obtained. 30% of yield.

[0037]

Composition of M-1

It flows back for 6 hours by adding B1.6g compounded above to inside in which isopropyl alcohol 20mL, the potassium hydrate 11.0g, and 0.01 g of hydroquinone were dissolved. Isopropyl alcohol is evaporated, it condenses and a methylene chloride/water extracts. Magnesium sulfate desiccation is carried out and vacuum concentration of the organic layer is carried out. If an obtained solid is recrystallized with heat methanol, 0.9g of white crystals M-1 will be obtained. 60% of yield.

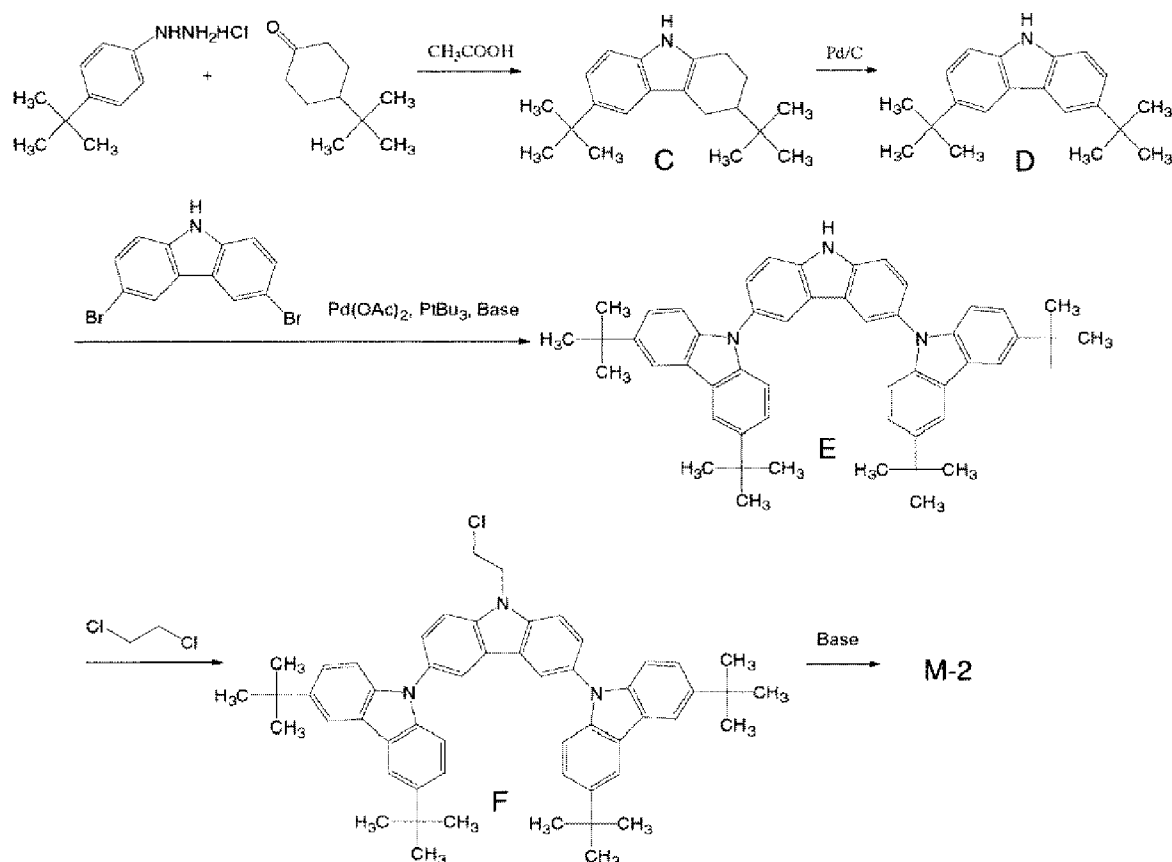
[0038]

The synthetic example 2

Composition of the illustration compound M-2

[0039]

[Formula 16]



[0040]

Composition of the intermediate C

The solution which melted 4-tertiary-butylphenylhydrazine hydrochloride 68.2g in acetic acid 800mL, and melted 56.4 g of 4-tertiary-butylcyclohexanone in acetic acid 80mL under heating stirring at 130 to 140 °C is dropped. It flows back for 1 hour and water 400mL is added. It suction-filters, and ethanol-washes, vacuum drying of the obtained white solid is carried out, and the white solid C38.3g is obtained.

[0041]

Composition of the intermediate D

C obtained above is melted in mesitylene 450mL, and it flows back by adding the palladium carbon 5.1g 10% for 6 hours. Cerite filtration of the reaction mixture is carried out, and ethyl acetate washes. If a solvent of an obtained filtrate is evaporated, condensation processing is carried out and it recrystallizes in a methylene chloride/hexane, the white needle crystal D29.3g will be obtained. Two steps of yield [31% of].

[0042]

Composition of M-2

A three-stage is henceforth reacted like the synthetic example 1, and the white crystals M-2 are obtained.

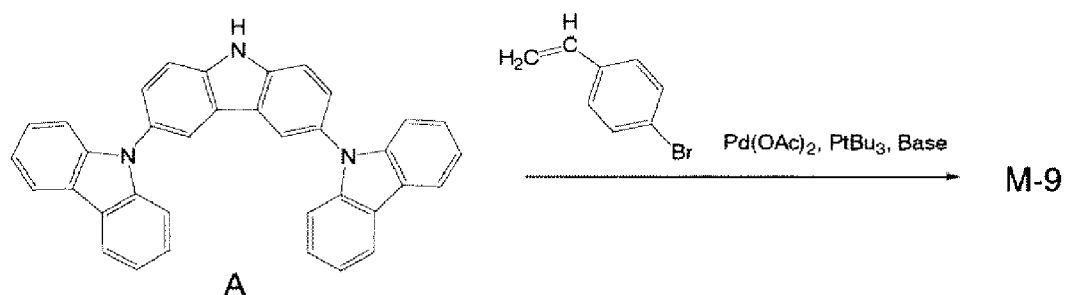
[0043]

The synthetic example 3

Composition of the illustration compound M-9

[0044]

[Formula 17]



[0045]

In orthoxylene 20mL in the eggplant flask by which the nitrogen purge was carried out, 1.8 g of 4-BUROMO styrene, A5.5g obtained in the synthetic example 1, 23 mg of palladium acetate, 61 mg of tritertiary-butylphosphine, 6.9 g of rubidium carbonate, and 10 mg of 2,6-ditertiary-butylphenol are prepared, and it is made to react at 120-130 °C for 7 hours. Ethyl acetate extraction, salt solution washing, magnesium sulfate desiccation, and a reactional solvent are evaporated, and output is condensed. 1.3g of white solids M-9 are obtained by refining and recrystallizing the obtained fluid with column chromatography. 20% of yield.

[0046]

(Carbazole derivative polymer)

This invention is polymer produced by polymerizing a carbazole derivative including at least one kind in a carbazole derivative expressed with general formula (I) to the 2nd. In this specification, carbazole derivative polymer is called polymer of this invention.

[0047]

A homopolymer in which polymer of this invention makes a constituent one kind in a compound (monomer) expressed with general formula (I), Or at least one kind of constituent of a copolymer which makes a constituent two or more kinds in a compound (monomer) expressed with general formula (I), and a compound (monomer) expressed with general formula (I), It is a copolymer which comprises a constituent from monomers other than a monomer expressed with general formula (I). In the case of a copolymer, any of a random copolymer or a block copolymer may be sufficient.

[0048]

Polymer of this invention may be a copolymer which has a constituent from a monomer expressed with general formula (I), i.e., a repeating unit expressed with said general formula (II), and a repeating unit which is the constituents from the other monomer as mentioned above. In this copolymer, a rate of a repeating unit expressed with general formula (II) to the sum total of the two above-mentioned sorts of repeating units is more than 50 mol % preferably, is more than 70 mol % more preferably, and is more than 80 mol % especially preferably.

[0049]

As monomers other than a monomer expressed with said general formula (I), it is usable in each vinyl monomer. This monomer may be used alone or may be used together. [two or more] As the example, styrene, alpha methylstyrene, butadiene, vinyl acetate, acrylic acid, methacrylic acid, acrylic ester, methacrylic acid ester, acrylamide, methacrylamide, a monomer that connected various functional groups with them, etc. are mentioned. A vinyl monomer which has various functional groups (each skeleton which shows a luminescence function, electron hole transportation ability, and electron transportation ability) is explained below.

[0050]

As a skeleton which shows a luminescence function, for example Benzooxazol, benzimidazole, Benzothiazole, styryl benzene, polyphenyl, diphenylbutadiene, Tetraphenylbutadiene, NAFUTARU imide, a coumarin, perylene, Pyrene and peri non, each functional group of oxadiazole, aldazine, PIRARIJIN, a cyclopentadiene, screw styryl anthracene, Quinacridone, pyrrolo pyridine, thiadiazolo pyridine, a cyclopentadiene, styryl amine, and aromatic JIMECHIRI DIN is mentioned. A coumarin, perylene, and pyrene are preferred, perylene and pyrene are [among these] more preferred, and pyrene is still more preferred.

[0051]

As a skeleton which shows electron hole transportation ability, for example Carbazole, triazole, Oxazol, oxadiazole, imidazole, a poly aryl alkane, Pyrazoline, a pyrazolone, a phenylenediamine, arylamine, amino substitution CULCON, Each functional group of styryl anthracene, fluorenone, hydrazone, a stilbene, a silazane, an aromatic tertiary-amine compound, a styryl amine compound, an aromatic JIMECHIRI DIN system compound, and porphyrin is mentioned. Carbazole, arylamine, and an aromatic tertiary-amine compound are preferred, carbazole and an aromatic tertiary-amine compound are [among these] more preferred, and an aromatic tertiary-amine compound is still more preferred.

[0052]

As a skeleton which shows electron transportation ability, for example Triazole, oxazol, Each functional group of oxadiazole, fluorenone, anthra quinodimethane, Antron, diphenylquinone, thiopyrandioxide, rib diimide, full ORENIRIDEN methane, JISUCHIRIRU pyrazine, naphthalene

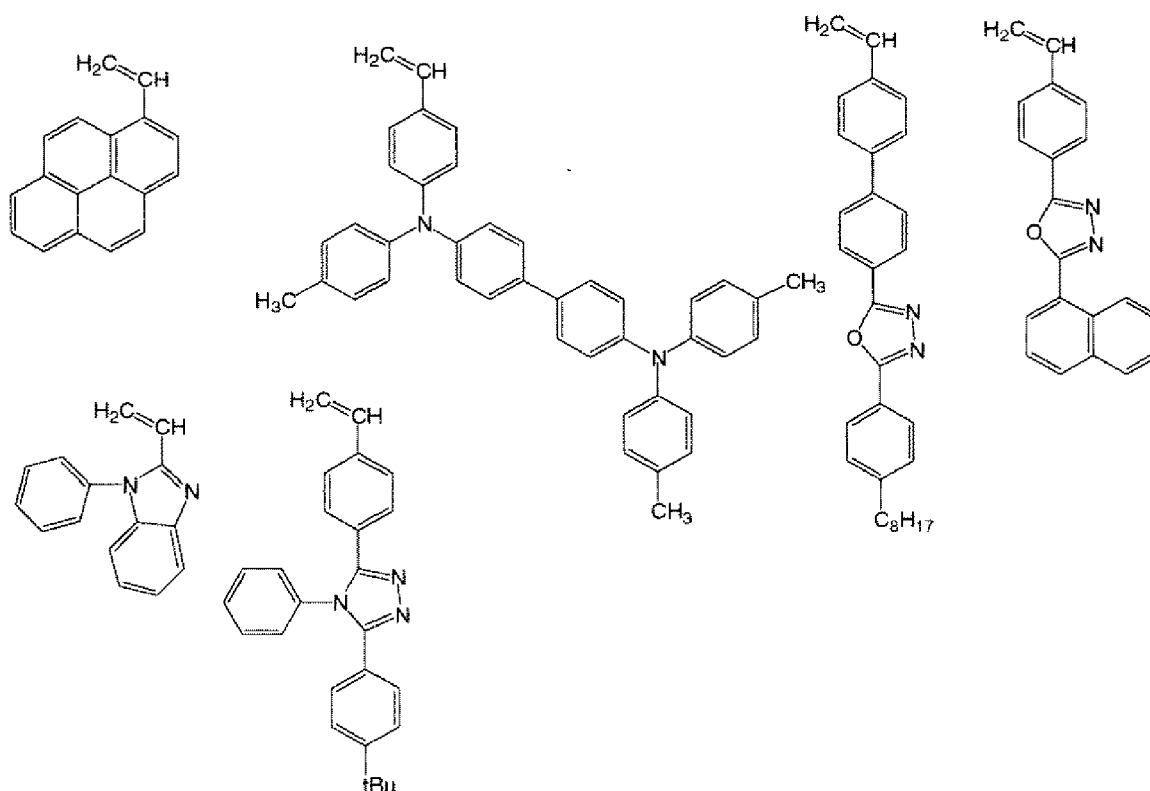
perylene, and phthalocyanine is mentioned. Triazole, oxazol, and oxadiazole are preferred, oxazol and oxadiazole are [among these] more preferred, and oxadiazole is still more preferred.

[0053]

The following structures are especially specifically preferred among vinyl monomers which furthermore have various functional groups (each skeleton which shows a luminescence function, electron hole transportation ability, and electron transportation ability).

[0054]

[Formula 18]



[0055]

The purity of the carbazole derivative monomer used for a polymerization, Even if it is considered as 10 - 99.99 mass % and compounds other than 50 to 99.99 mass % and the bis (carbazolyl)carbazole derivative monomer which is 70 to 99.99 mass % still more preferably, and is expressed with general formula (I) are contained preferably, a polymerization reaction advances.

[0056]

Although there is no restriction in particular and general techniques, such as a radical polymerization, cationic polymerization, living cationic polymerization, anionic polymerization,

living anionic polymerization, and coordination polymerization, are used, a radical polymerization, cationic polymerization, and living cationic polymerization are preferably used for the polymerization method of polymer of this invention. Target polymer can be arbitrarily obtained by changing factors, such as reaction temperature, a reactional solvent, reaction time, and a reactional initiator, with each of these polymerization methods.

[0057]

Although a molecular weight of polymer of this invention changes with a polymerization method and conditions, 5 million or less [1000 or more] are preferred, it is more desirable still more preferred that it is [or more 2000] 2 million or less, and weight average molecular weight is 1 million or less [3000 or more]. 2 million or less [500 or more] are preferred, it is more desirable still more preferred that it is 1 million 1000 or more, and a number average molecular weight is 500000 or less [2000 or more]. Weight average molecular weight/number average molecular weight is from 1 to 20, is from 1 to 15 preferably, and is from 1 to 10 still more preferably.

[0058]

Although tacticity of polymer of this invention changes with a polymerization method and conditions, syndiotactic one, isotactic ones, syndiotactic one / isotactic mixing, and atactic all can be taken.

[0059]

Especially an end group of polymer of this invention can be embellished in living polymerization, although not limited.

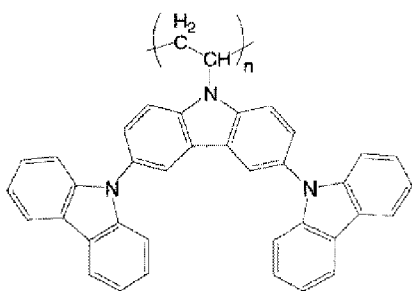
[0060]

Although an example of polymer of this invention is given to below, this invention is not limited to these. n expresses among a formula an integer which ****ed in a molecular weight, and a terminal part is omitted.

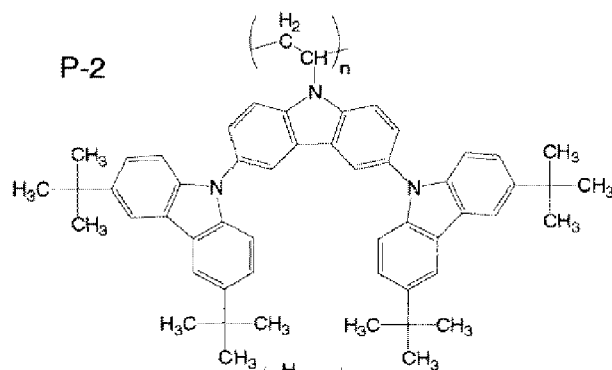
[0061]

[Formula 19]

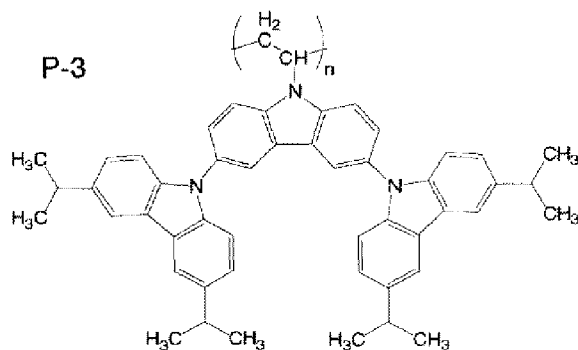
P-1



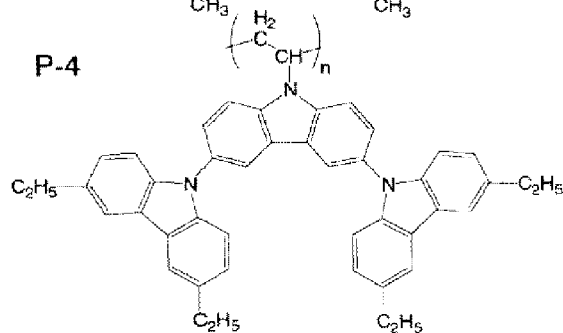
P-2



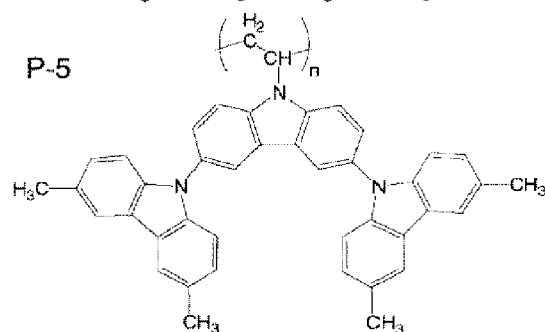
P-3



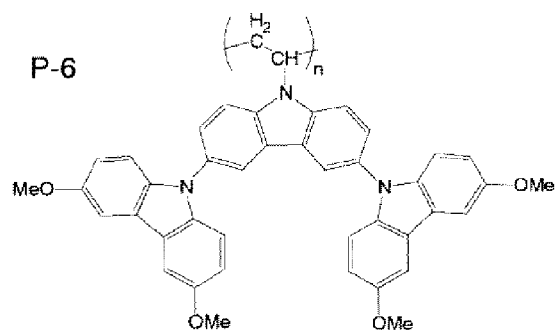
P-4



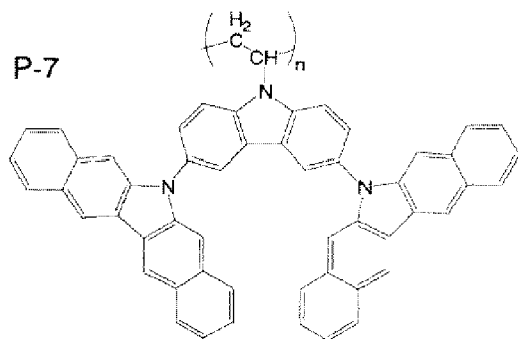
P-5



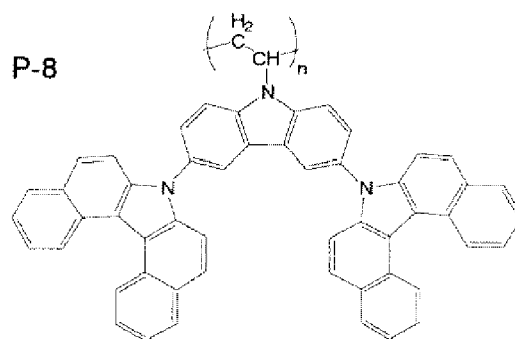
P-6



P-7



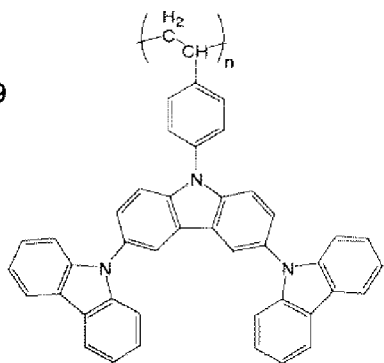
P-8



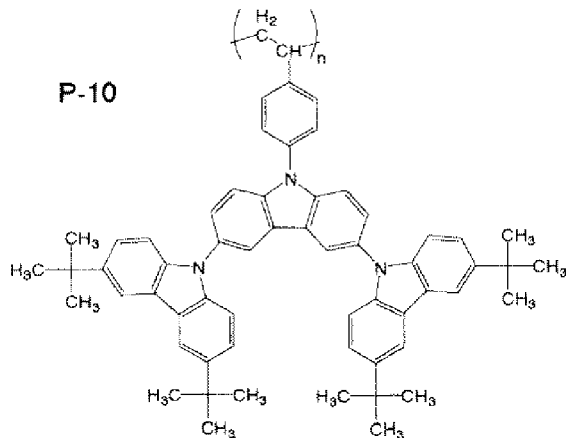
[0062]

[Formula 20]

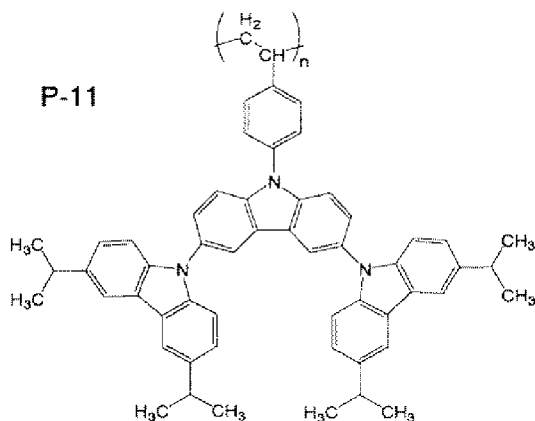
P-9



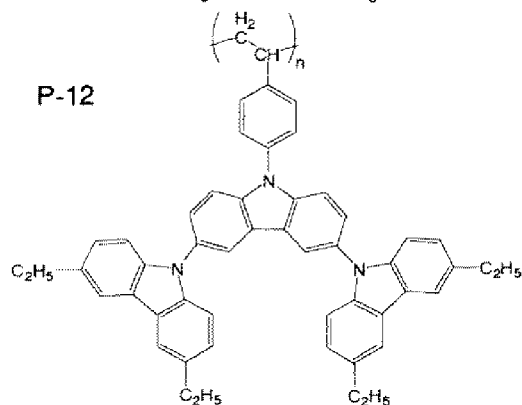
P-10



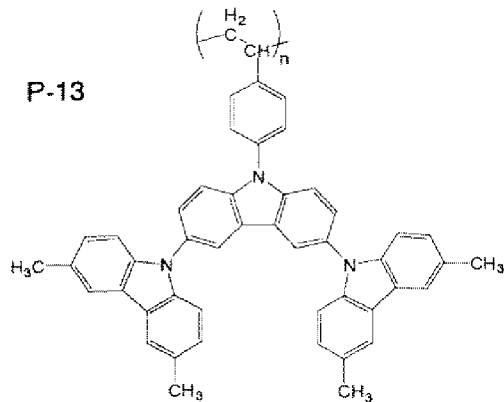
P-11



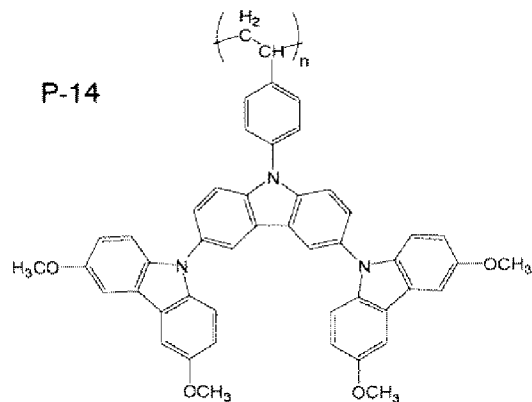
P-12



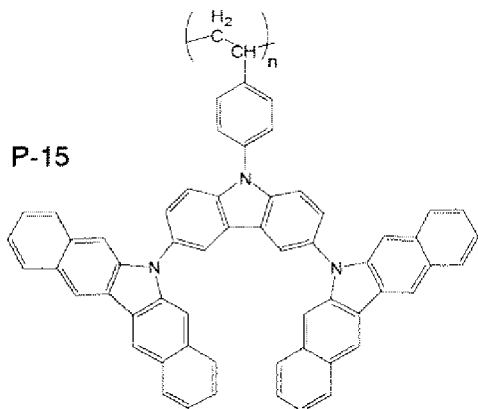
P-13



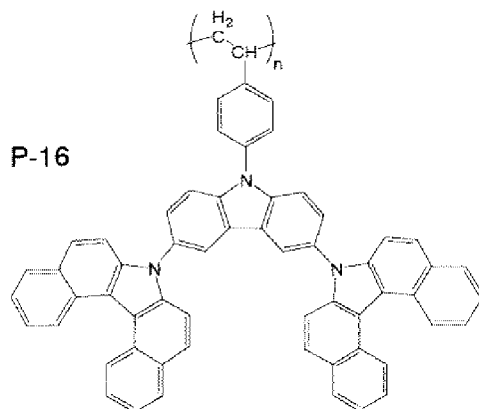
P-14



P-15



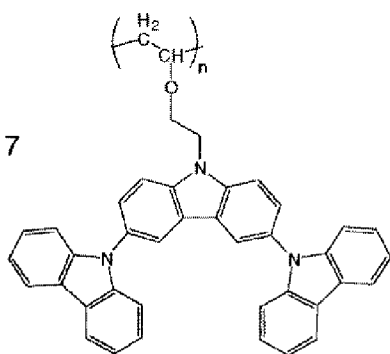
P-16



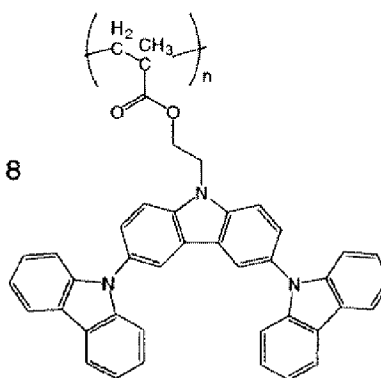
[0063]

[Formula 21]

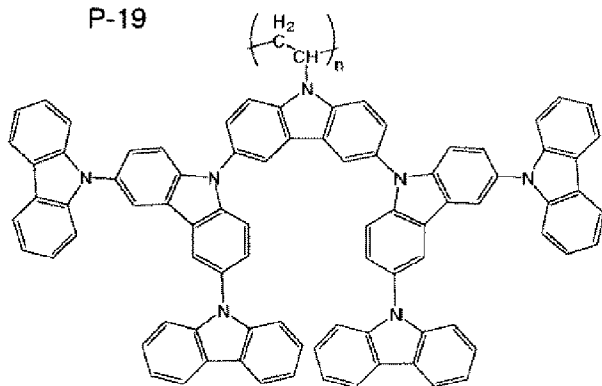
P-17



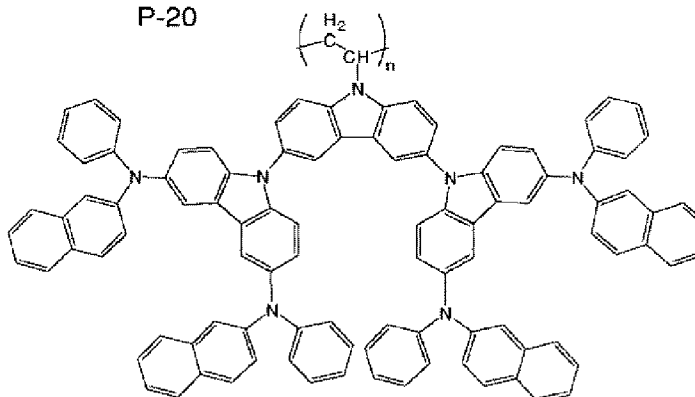
P-18



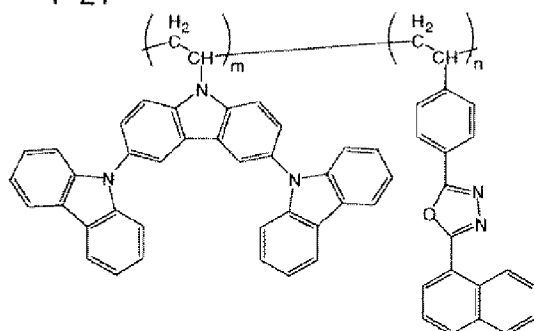
P-19



P-20



P-21



$$m : n = 85 : 15 \text{ (モル比)}$$

[0064]

Next, a part of synthetic example of polymer of this invention is shown below.

[0065]

The synthetic example 4

Manufacture of the illustration compound P-1

M-1 Make it dissolve in toluene 3mL, and make 650 mg and 1.0 mg of azobisisobutyronitrile react at 70 to 80 ** for 6 hours. Methanol 200mL is filled with a reaction mixture, and a white solid is reprecipitated. This white solid is dissolved in toluene, and it filters, and pours and reprecipitates in methanol. Vacuum drying of the white solid obtained by performing this toluene / methanol reprecipitation once [further] is carried out at 70 to 80 **. 500 mg of white solids P-1 are obtained. By a gel permeation chromatography, the weight average molecular weight (Mw) of the obtained polymer is set to 15000, and a number average molecular weight (Mn) is set to 45000.

[0066]

The synthetic example 5

Manufacture of the illustration compound P-2

A polymerization reaction is performed for M-2 in a raw material like the synthetic example 4, and P-2 is obtained.

[0067]

The synthetic example 6

Manufacture of the illustration compound P-9

A polymerization reaction is performed for M-9 in a raw material like the synthetic example 4, and P-9 is obtained.

[0068]

(Light emitting device)

This invention is a light emitting device which has two or more organic layers which contain [third] a luminous layer or a luminous layer in inter-electrode [of couple], and is a light emitting device (in this specification, it is defined as a light emitting device of this invention), wherein at least one layer contains polymer of this invention.

[0069]

A light emitting device of this invention can be carried out like a system of the usual light emitting device, a drive method, and a usage pattern except a point of using an element using said polymer of this invention. An organic EL device can be mentioned as a typical light emitting device. Next, this is explained in full detail.

[0070]

When using as an organic EL device, can use the aforementioned polymer of this invention also as any of a charge of a hole injecting material, a hole carrying material, luminous layer material, an electron transport material, and electron injection material, but. desirable --

luminous layer material, a hole carrying material, and a charge of a hole injecting material -- further -- desirable -- luminous layer material -- it can be especially used conveniently as a host material in luminous layer material preferably.

[0071]

Polymer of this invention may be used alone, or it may be used, using together with other organic materials and inorganic materials. Organic materials used together may be low molecule organic materials, or may be polymer materials. It is also possible to use it, carrying out laminate coating to other macromolecular organic materials. It is also possible to mix with a low molecular weight compound, and to laminate and use it. In this case, a low molecular weight compound may be mixed with a polymer binder, and may apply, or may be laminated by methods, such as vacuum deposition and sputtering.

[0072]

A formation method of an organic layer of a light emitting device containing polymer of this invention, Although not limited in particular, resistance heating vacuum evaporation, an electron beam, sputtering, Methods, such as a molecule laminated layers method, a coating method, the ink jet method, print processes, and a xerography, are used, and resistance heating vacuum evaporation, a coating method, and a replica method are preferred in respect of the characteristic and manufacture, and a coating method is more preferred from a point of pyrolysis evasion at the time of vacuum evaporation.

[0073]

A light emitting device of this invention is an element in which two or more organic compound films which contain a luminous layer or a luminous layer in inter-electrode [of a couple of the anode and the negative pole] were formed, It may have a hole injection layer besides a luminous layer, an electron hole transporting bed, an electronic injection layer, an electron transport layer, a protective layer, etc., and these each class may be provided with other functions, respectively. Various materials can be used for formation of each class, respectively.

[0074]

The anode can supply an electron hole to a hole injection layer, an electron hole transporting bed, a luminous layer, etc., metal, an alloy, a metallic oxide, electrical conductivity compounds, or these mixtures can be used, and a work function is not less than 4-eV material preferably. As an example, conductive metallic oxide, such as tin oxide, a zinc oxide, indium oxide, and indium tin oxide (ITO), Or a mixture or laminated material of metal, such as gold, silver, chromium, and nickel, and also these metal, and conductive metallic oxide, Organic conductive materials, such as inorganic conductive substances, such as copper iodide and copper sulfide, poly aniline, a polythiophene, and polypyrrole, laminated material of these and ITO, etc. are mentioned, preferably, it is conductive metallic oxide and ITO is preferred from points, such as

productivity, high conductivity, and transparency, especially.

[0075]

Usually a thing of the range of 10 nm - 5 micrometers is preferred, and are 50 nm - 1 micrometer more preferably, and thickness of the anode is 100 nm - 500 nm still more preferably, although it is selectable suitably by material.

[0076]

What usually carried out the stratification of the anode on soda lime glass, alkali free glass, transparent resin boards, etc. is used. When using glass, in order to lessen elution ion from glass, about the construction material, it is preferred to use alkali free glass. When using soda lime glass, it is preferred to use what gave barrier coating sealant, such as silica. If thickness of a substrate is enough to maintain a mechanical strength, there will be no restriction in particular, but in using glass, it usually uses a thing of 0.7 mm or more preferably 0.2 mm or more.

[0077]

Although various methods are used for production of the anode with material, when it is ITO, for example, film formation is carried out by methods, such as spreading of a dispersed matter of an electron beam method, sputtering process, resistance heating vacuum deposition, chemical reaction methods (sol-gel method etc.), and indium tin oxide. By washing and other processings, the anode can drop driver voltage of an element or can also raise luminous efficiency. For example, in ITO, UV-ozonization, plasma treatment, etc. are effective.

[0078]

The negative pole supplies an electron to an electronic injection layer, an electron transport layer, a luminous layer, etc., and is chosen in consideration of adhesion with a layer, ionization potential, stability which adjoin negative electrodes, such as an electronic injection layer, an electron transport layer, and a luminous layer. As a material of the negative pole, metal, an alloy, a metal halogenide, a metallic oxide, an electrical conductivity compound, Or these mixtures can be used and it is an alkaline metal (for example) as an example. [Li and] the fluorides, such as Na, K, and Cs, an oxide, and alkaline-earth metals (for example, Mg.) The fluorides, such as Ca, an oxide, gold, silver, lead, ARUNIUMU, sodium potassium alloys, or those mixed metals, Lithium aluminum alloys or those mixed metals, magnesium silver alloys, or those mixed metals, Rare earth metals, such as indium and ITTERIBIUMU, etc. are mentioned, a work function is material of 4 eV or less preferably, and they are aluminum, lithium aluminum alloys or those mixed metals, magnesium silver alloys, or those mixed metals more preferably. The negative pole can also take a laminated structure containing not only layer structure of the above-mentioned compound and a mixture but the above-mentioned compound and a mixture.

[0079]

Usually a thing of the range of 10 nm - 5 micrometers is preferred, and are 50 nm - 1 micrometer more preferably, and thickness of the negative pole is 100 nm - 1 micrometer still more preferably, although it is selectable suitably by material.

[0080]

Methods, such as an electron beam method, sputtering process, resistance heating vacuum deposition, and a coating method, are used for production of the negative pole, and vapor-depositing metal alone can also vapor-deposit two or more ingredients simultaneously. An alloy which is possible also for vapor-depositing two or more metal simultaneously, and forming an alloy electrode, and was adjusted beforehand may be made to vapor-deposit. The lower one of sheet resistance of the anode and the negative pole is preferred, and below hundreds of ohms / ** are preferred.

[0081]

The material of a luminous layer can pour in an electron hole from the anode or a hole injection layer, and an electron hole transporting bed at the time of an applied electric field, and The negative pole or an electronic injection layer, A function in which an electron can be poured in from an electron transport layer, and a function, to which a poured-in electric charge is moved, As long as it can form a layer which has the function to provide an electron hole and a place of electronic recombination and to make them emit light, a singlet exciton or a triplet exciton may often emit [anything] light either. Although it is a transition metal complex and a thing which contains an alt.metal-ized metal complex still more preferably preferably, other luminescent materials can also be used together and used. For example, benzooxazol, benzimidazole, benzothiazole, Styryl benzene, polyphenyl, diphenylbutadiene, tetraphenylbutadiene, NAFUTARU imide, coumarin, perylene, and peri non, oxadiazole, Aldazine, PIRARIJIN, a cyclopentadiene, screw styryl anthracene, Quinacridone, pyrrolo pyridine, thiadiazolo pyridine, a cyclopentadiene, Polymer compounds [, such as a polythiophene, polyphenylene, and polyphenylene vinylene,], such as various metal complexes represented by styryl amine, aromatic dimethyldyne compounds and these derivatives, and a metal complex and a rare earth complex of an eight quinolinol, etc. are mentioned.

[0082]

Although thickness in particular of a luminous layer is not limited, usually a thing of the range of 1 nm - 5 micrometers is preferred, and are 5 nm - 1 micrometer more preferably, and it is 10 nm - 500 nm still more preferably.

[0083]

Although a formation method in particular of a luminous layer is not limited, resistance heating vacuum evaporation, Methods, such as an electron beam, sputtering, a molecule laminated layers method, coating methods (a spin coat method, the cast method, a dip coating method, etc.), the LB method, the ink jet method, print processes, a replica method, and a xerography,

are used, and they are resistance heating vacuum evaporation and a coating method preferably.

[0084]

The material of a hole injection layer and an electron hole transporting bed should just be carrying out the owner of a function to pour in an electron hole from the anode, a function to convey an electron hole, and the function that carries out the barrier of the electron poured in from the negative pole either. As the example, carbazole, triazole, oxazol, Oxadiazole, imidazole, a poly aryl alkane, pyrazoline, A pyrazolone, a phenylenediamine, arylamine, amino substitution CULCON, Styryl anthracene, fluorenone, hydrazone, a stilbene, a silazane, An aromatic tertiary-amine compound, a styryl amine compound, an aromatic JIMECHIRI DIN system compound, Conductive polymer oligomer, such as a porphyrin system compound, polysilane system compounds and these derivatives, poly (N-vinylcarbazole), an aniline system copolymer, thiophene oligomer, and a polythiophene, a carbon film, etc. are mentioned.

[0085]

Although thickness in particular of a hole injection layer and an electron hole transporting bed is not limited, usually a thing of the range of 1 nm - 5 micrometers is preferred, and are 5 nm - 1 micrometer more preferably, and it is 10 nm - 500 nm still more preferably. A hole injection layer and an electron hole transporting bed may be layer structures which consist of one sort of material mentioned above, or two sorts or more, and may be multilayer structure which consists of two or more layers of the same presentation or a different-species presentation.

[0086]

As a formation method of a hole injection layer and an electron hole transporting bed, a vacuum deposition method, the LB method, the ink jet method, print processes, a replica method, a xerography, methods (a spin coat method, the cast method, a dip coating method, etc.) of dissolving or distributing a solvent and coating it with said hole-injection transportation agent, etc. are used. In the case of a coating method, can dissolve or distribute with a resinous principle and as a resinous principle for example, Polyvinyl chloride, polycarbonate, polystyrene, polymethylmethacrylate, Polybutyl methacrylate, polyester, polysulfone, polyphenylene oxide, Polybutadiene, poly (N-vinylcarbazole), hydrocarbon resin, Ketone resin, phenoxy resin, polyamide, ethyl cellulose, vinyl acetate, ABS plastics, polyurethane, melamine resin, unsaturated polyester resin, alkyd resin, an epoxy resin, silicon resin, etc. are mentioned.

[0087]

The material of an electronic injection layer and an electron transport layer should just be carrying out the owner of a function to pour in an electron from the negative pole, a function to convey an electron, and the function that carries out the barrier of the electron hole poured in

from the anode either. As the example, triazole, oxazol, oxadiazole, Fluorenone, anthra quinodimethane, Antron, diphenylquinone, Thiopyrandioxide, rib diimide, full ORENIRIDEN methane, Heterocyclic tetracarboxylic anhydrides, such as JISUCHIRIRU pyrazine and naphthalene perylene, Various metal complexes etc. which are represented by metal complex which makes a ligand phthalocyanines and these derivatives, an eight quinolinol and a metal complex of these derivatives and metal phthalocyanine, benzooxazol, and benzothiazole are mentioned.

[0088]

Although thickness in particular of an electronic injection layer and an electron transport layer is not limited, usually a thing of the range of 1 nm - 5 micrometers is preferred, and are 5 nm - 1 micrometer more preferably, and it is 10 nm - 500 nm still more preferably. An electronic injection layer and an electron transport layer may be layer structures which consist of one sort of material mentioned above, or two sorts or more, and may be multilayer structure which consists of two or more layers of the same presentation or a different-species presentation.

[0089]

As a formation method of an electronic injection layer and an electron transport layer, a vacuum deposition method, the LB method, the ink jet method, print processes, a replica method, a xerography, methods (a spin coat method, the cast method, a dip coating method, etc.) of dissolving or distributing a solvent and coating it with said electron injection transportation agent, etc. are used. In the case of a coating method, it can dissolve or distribute with a resinous principle, and what was illustrated as a resinous principle in the case of for example, a hole-injection transporting bed can be applied.

[0090]

What is necessary is just to have a function which deters that what promotes element deterioration, such as moisture and oxygen, as a material of a protective layer enters in an element. As the example, In, Sn, Pb, Au, Cu, Ag, aluminum, Metal, such as Ti and nickel, MgO, SiO, SiO₂, aluminum₂O₃, GeO, NiO, CaO, BaO, Fe₂O₃, Y₂O₃, Metallic oxides, such as TiO₂, MgF₂, LiF, AlF₃, Metal fluorides, such as CaF₂, polyethylene, polypropylene, Polymethylmethacrylate, polyimide, poly urea, polytetrafluoroethylene, Polychlorotrifluoroethylene resin, poly dichlorodifluoroethene, A copolymer of chlorotrifluoroethylene and dichlorodifluoroethene, A copolymer produced by making carry out copolymerization of the monomer mixture containing tetrafluoroethylene and at least one sort of comonomers, a fluorine-containing copolymer which has cyclic structure in a copolymerization main chain, an absorptivity substance of 1% or more of water absorption, a dampproof substance of 0.1% or less of water absorption, etc. are mentioned.

[0091]

Also about a formation method of a protective layer, there is no limitation in particular and For

example, a vacuum deposition method, sputtering process, A reactive-sputtering method, the MBE (molecular beam epitaxy) method, the ionized cluster beam method, The ion plating method, the plasma polymerizing method (the high-frequency excitation ion plating method), plasma CVD method, a laser CVD method, a heat CVD method, a gas sauce CVD method, a coating method, the ink jet method, print processes, and a replica method are applicable.

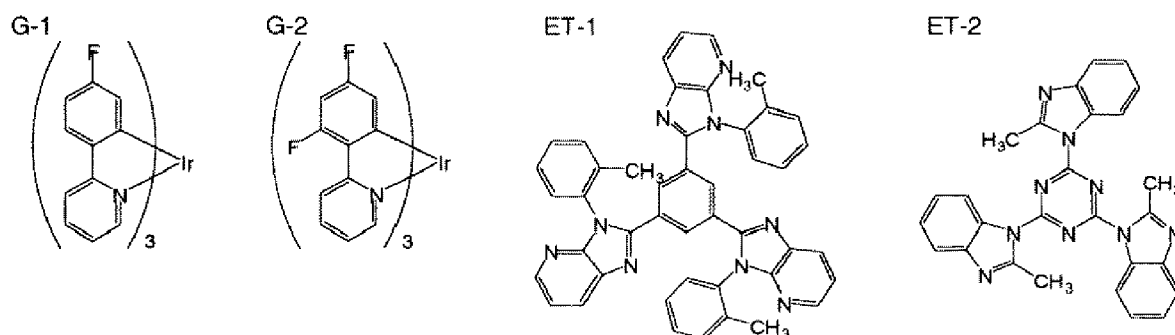
[0092]

[Example]

This invention is not limited by these examples although the example and comparative example of this invention are illustrated and explained below. With reference to JP,2002-100476,A, the luminous layer host G-1, G-2 and electron transport material ET-1, and ET-2 of the following are compoundable.

[0093]

[Formula 22]



[0094]

Example 1

Let what produced ITO by a thickness of 150 nm on the 25mmx25mmx0.7mm glass substrate (made by Tokyo Sanyo Vacuum Co., Ltd.) be a transparent supporting board. This transparent supporting board is etched and washed. After carrying out the spin coat of Baytron P (a trade name, a PEDOT-PSS solution (polyethylene dioxythiophene polystyrene sulfonate dope object) / Beyer company make) of a hole transporting bed on this ITO glass substrate, vacuum drying is carried out at 100 °C for 1 hour (about 50 nm of thickness). It dissolves in 2.5 g of 1,2-dichloroethane, and the spin coat of luminous layer host compound P-1 20mg of this invention, luminous layer guest compound G-1(above-mentioned structure)1mg, and the electron transport material ET-1(above-mentioned structure)6mg is carried out on the washed substrate (about 170 nm of thickness). Furthermore, about 1 nm of thickness is vapor-deposited for LiF under the condition of a substrate temperature room temperature in the vacuum of 10^{-3} - 10^{-4} Pa in order. The mask (mask in which an emission area is set to 5 nm x 4 nm) besides

patterned is installed, about 200 nm of thickness vapor-deposits aluminum, and an element is produced. The produced element is closed within a dry glove box.

[0095]

Example 2

In the element of Example 1, an element is produced completely like Example 1 except having used the luminous layer host compound P-2 of this invention instead of the luminous layer host compound P-1 of this invention.

[0096]

Example 3

In the element of Example 1, an element is produced completely like Example 1 except having used the luminous layer host compound P-9 of this invention instead of the luminous layer host compound P-1 of this invention.

[0097]

Example 4

In the element of Example 1, an element is produced completely like Example 1 except having used the luminous layer guest compound G-2 (the above-mentioned structure) instead of the luminous layer guest compound G-1.

[0098]

Example 5

In the element of Example 4, an element is produced completely like Example 1 except having used the luminous layer host compound P-9 of this invention instead of the luminous layer host compound P-1 of this invention.

[0099]

Comparative example 1

Composition of a comparison compound polyvinyl carbazole (PVK): In the synthetic example 4, except having replaced the starting material M-1 with vinylcarbazole, make it polymerize completely like the synthetic example 4, and obtain PVK. In the element of Example 1, the above PVK is used instead of the luminous layer host compound P-1 of this invention, and an element is produced like Example 1.

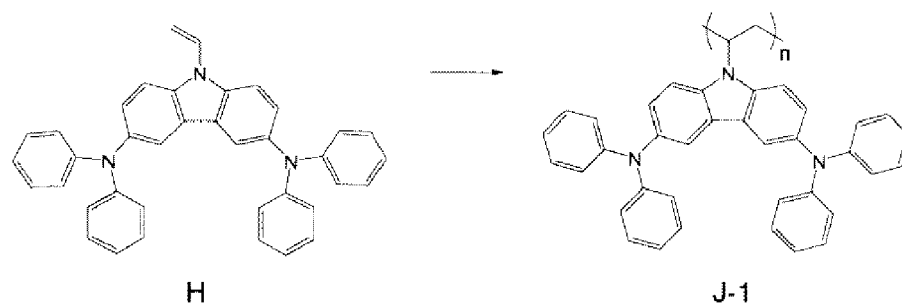
[0100]

Comparative example 2

Composition of the comparison compound J-1: Compound the monomer H completely like the synthetic example 1 in the synthetic example 1 except having replaced the carbazole of the starting material with diphenylamine. Except having used this instead of M-1, it is made to polymerize completely like the synthetic example 4, and J-1 is obtained.

[0101]

[Formula 23]



[0102]

In the element of Example 1, an element is produced completely like Example 1 except having used the comparison compound J-1 instead of the luminous layer host compound P-1 of this invention.

[0103]

Comparative example 3

In the element of the comparative example 1, an element is produced completely like the comparative example 1 except having used the above G-2 instead of the luminous layer guest compound G-1 of this invention.

[0104]

Comparative example 4

In the element of the comparative example 2, an element is produced completely like the comparative example 2 except having used the above G-2 instead of the luminous layer guest compound G-1 of this invention.

[0105]

Example 6

Let what produced ITO by a thickness of 150 nm on the 25mmx25mmx0.7mm glass substrate (made by Tokyo Sanyo Vacuum Co., Ltd.) be a transparent supporting board. This transparent supporting board was etched and washed. After carrying out the spin coat of Baytron P (a PEDOT-PSS solution (polyethylene dioxythiophene polystyrene sulfonate dope object) / Beyer company make) of a hole transporting bed on this ITO glass substrate, vacuum drying is carried out at 100 °C for 1 hour (about 50 nm of thickness). The spin coat of the solution which besides dissolved luminous layer host compound P-1 20mg of this invention and luminous layer guest compound G-2(above-mentioned structure)1mg in 1 and 2 dichloromethane 3mL is carried out (about 70 nm of thickness). Subsequently, an electron transport material (ET-2, the above-mentioned structure) is vapor-deposited (about 70 nm of thickness). Furthermore, about 1 nm of thickness is vapor-deposited for LiF under the condition of a substrate temperature room temperature in the vacuum of 10^{-3} - 10^{-4} Pa in order. The mask (mask in which an

emission area is set to 5 nm x 4 nm) besides patterned is installed, about 200 nm of thickness vapor-deposits aluminum, and an element is produced. The produced element is closed within a dry glove box.

[0106]

Example 7

In the element of Example 6, an element is produced completely like Example 6 except having used the luminous layer host compound P-2 of this invention instead of the luminous layer host compound P-1 of this invention.

[0107]

Example 8

In the element of Example 6, an element is produced completely like Example 6 except having used the luminous layer host compound P-9 of this invention instead of the luminous layer host compound P-1 of this invention.

[0108]

Comparative example 5

In the element of Example 6, an element is produced completely like Example 6 except having used the above PVK instead of the luminous layer host compound P-1 of this invention.

[0109]

Comparative example 6

In the element of Example 6, an element is produced completely like Example 6 except having used the comparison compound J-1 instead of the luminous layer host compound P-1 of this invention.

[0110]

Element evaluation

Direct current voltage is impressed to each element, and is made to emit light using the TOYO sauce major unit 2400. A luminous wavelength and a chromaticity coordinate are measured for the luminosity using Hamamatsu Photonics spectrum analyzer PMA-11 using TOPCON CORP. make luminance meter BM-8. Based on these figures, external quantum efficiency is computed by the luminosity converting method.

[0111]

The above result is summarized in a lower table.

[0112]

[Table 1]

表 1

発光素子	発光層		電子 輸送材	発光波長 (nm)	外部量子 効率
	ホスト	ゲスト			
実施例1	P-1	G-1	ET-1	486	9.1
実施例2	P-2	G-1	ET-1	486	9.5
実施例3	P-9	G-1	ET-1	486	8.5
実施例4	P-1	G-2	ET-1	474	8.3
実施例5	P-9	G-2	ET-1	474	8.9
比較例1	PVK	G-1	ET-1	486	3.2
比較例2	J-1	G-1	ET-1	486	4.5
比較例3	PVK	G-2	ET-1	474	2.1
比較例4	J-1	G-2	ET-1	474	3.3
実施例6	P-1	G-2	ET-2	474	8.8
実施例7	P-2	G-2	ET-2	474	9.1
実施例8	P-9	G-2	ET-2	474	8.1
比較例5	PVK	G-2	ET-2	474	3.7
比較例6	J-1	G-2	ET-2	474	4.9

[0113]

The element which used carbazole derivative polymer of this invention for the luminous layer host material has the external quantum efficiency of blue - blue-green luminescence higher than the element which used a conventional polyvinyl carbazole or polyvinyl (diaryl) carbazole for the luminous layer host material so that clearly from the above-mentioned table. That is, it is more suitable than the conventional blue - a blue-green luminescence host material.

[0114]

[Effect of the Invention]

By this invention, the blue in which high luminous efficiency is possible - a blue-green light emitting device can be provided using an application process. That is, the carbazole derivative of this invention is suitable to compound said polymer, and the element which used this polymer for the luminous layer host material does so the above-mentioned outstanding operation effect.

[Translation done.]